

Quantitative kHz to MHz Frame Rate Flow Diagnostics for Aerodynamic Ground Test Facilities, Phase I

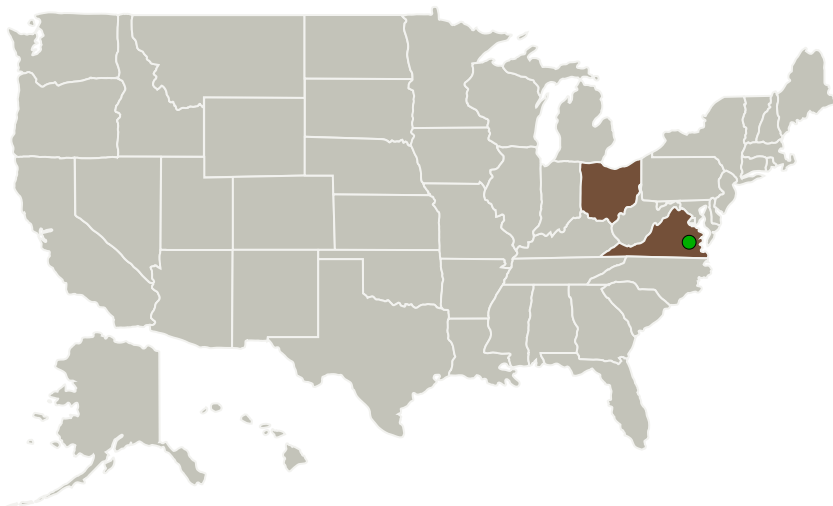
Completed Technology Project (2010 - 2010)



Project Introduction

The proposed Phase I SBIR program will study the feasibility of building next-generation burst-mode laser diagnostics that will enable unparalleled planar imaging capabilities for quantitative analysis of flow parameters, such as velocity, temperature, and species concentration in large-scale hypersonic flow facilities, including short run duration "impulse" facilities. In particular, the instrumentation would provide the unique capability for measurements of multiple parameters at data collection rates as high as ~ 1 MHz with flexible wavelength and interpulse spacing for quantitative velocimetry and thermometry. During the Phase I, the proposal team will study the feasibility of developing burst-mode Nd:YAG technology with programmable temporal output while pumping a wavelength-agile UV OPO for multi-line fluorescence imaging. This requires innovation of the burst-mode pump laser to allow dual-pulse seeding, an appropriate chain of laser amplifiers, and a narrowband OPO designed for pulse-pair operation and rapid wavelength switching. Proof-of-concept demonstrations of NO molecular tagging velocimetry (MTV) and two-line NO PLIF will be accomplished in a laboratory scale high-speed flow facility (up to Mach 5). Finally, the feasibility of performing high frame rate (~ 50 kHz) imaging in high enthalpy impulse facilities using Rayleigh scattering will also be evaluated. This program will enable prototype development of a next generation ultra-high frame rate imaging system for high-speed flows, demonstration tests in NASA facilities, and the potential delivery of a prototype system to NASA during the Phase II.

Primary U.S. Work Locations and Key Partners



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| Organizations Performing Work | Role | Type | Location |
|---------------------------------|-------------------------|---|-------------------|
| Spectral Energies, LLC | Lead Organization | Industry Small Disadvantaged Business (SDB) | Dayton, Ohio |
| ● Langley Research Center(LaRC) | Supporting Organization | NASA Center | Hampton, Virginia |

Primary U.S. Work Locations

| | |
|------|----------|
| Ohio | Virginia |
|------|----------|

Project Transitions

▶ **January 2010:** Project Start

✓ **July 2010:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/139357>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Spectral Energies, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

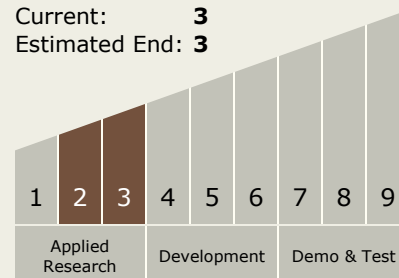
Sukesh Roy

Technology Maturity (TRL)

Start: 2

Current: 3

Estimated End: 3



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Technology Areas

Primary:

- TX13 Ground, Test, and Surface Systems
 - └ TX13.2 Test and Qualification
 - └ TX13.2.5 Flight and Ground Testing Methodologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System